



# Smart contracts security assessment

Final report

[Tariff: Standard](#)

## LiquidLocker

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## Introduction

The report has been prepared for LiquidNFTs team.

The audited code is available at [@wise-foundation/liquidnfts-audit-scope/contracts](#) Github repository and was audited after commit [6fc41c8](#). A recheck has been done after commit [bb432ec](#).

The audited contract makes it possible to borrow tokens secured by NFT, as well as lend tokens at interest.

Late payment penalties are charged. If the borrower has missed payments by 7 days his NFT will transfer to either the single provider address or the trusted multisig to be auctioned.

Name	LiquidLocker
Audit date	2022-03-31 - 2022-04-02
Language	Solidity
Platform	Ethereum

## Contracts checked

Name	Address
LiquidBase	
LiquidHelper	
LiquidLocker	
LiquidTransfer	

## Procedure

We perform our audit according to the following procedure:

### Automated analysis

- Scanning the project's smart contracts with several publicly available automated Solidity analysis tools
- Manual verification (reject or confirm) all the issues found by the tools

### Manual audit

- Manually analyse smart contracts for security vulnerabilities
- Smart contracts' logic check

## Known vulnerabilities checked

Title	Check result
<u>Unencrypted Private Data On-Chain</u>	passed
<u>Code With No Effects</u>	passed
<u>Message call with hardcoded gas amount</u>	passed
<u>Typographical Error</u>	passed
<u>DoS With Block Gas Limit</u>	passed
<u>Presence of unused variables</u>	passed
<u>Incorrect Inheritance Order</u>	passed
<u>Requirement Violation</u>	passed
<u>Weak Sources of Randomness from Chain Attributes</u>	passed
<u>Shadowing State Variables</u>	passed
<u>Incorrect Constructor Name</u>	passed
<u>Block values as a proxy for time</u>	passed
<u>Authorization through tx.origin</u>	passed
<u>DoS with Failed Call</u>	passed
<u>Delegatecall to Untrusted Callee</u>	passed

<u>Use of Deprecated Solidity Functions</u>	passed
<u>Assert Violation</u>	passed
<u>State Variable Default Visibility</u>	passed
<u>Reentrancy</u>	passed
<u>Unprotected SELFDESTRUCT Instruction</u>	passed
<u>Unprotected Ether Withdrawal</u>	passed
<u>Unchecked Call Return Value</u>	passed
<u>Floating Pragma</u>	passed
<u>Outdated Compiler Version</u>	passed
<u>Integer Overflow and Underflow</u>	passed
<u>Function Default Visibility</u>	passed

## Classification of issue severity

<b>High severity</b>	High severity issues can cause a significant or full loss of funds, change of contract ownership, major interference with contract logic. Such issues require immediate attention.
<b>Medium severity</b>	Medium severity issues do not pose an immediate risk, but can be detrimental to the client's reputation if exploited. Medium severity issues may lead to a contract failure and can be fixed by modifying the contract state or redeployment. Such issues require attention.
<b>Low severity</b>	Low severity issues do not cause significant destruction to the contract's functionality. Such issues are recommended to be taken into consideration.

## Issues

## High severity issues

No issues were found

## Medium severity issues

No issues were found

## Low severity issues

### 1. Max rate is not checked (FIXED) (LiquidLocker)

The locker owner can use `updateSettings()` or `increasePaymentRate()` to set `globals.paymentRate` to be greater than the `RATE_MAX`.

```
function updateSettings(
  uint256 _newPaymntRate,
  uint256 _newPaymentTime
)
  external
  onlyLockerOwner
  onlyDuringContributionPhase
{
  require(
    _newPaymntRate > globals.paymentRate,
    "LiquidLocker: INVALID_RATE"
  );

  globals.paymentRate = _newPaymntRate;

  ...
}
```

```
function increasePaymentRate(
  uint256 _newPaymntRate
)
```

```
external
onlyLockerOwner
onlyDuringContributionPhase
{
  require(
    _newPaymntRate > globals.paymentRate,
    "LiquidLocker: INVALID_INCREASE"
  );

  globals.paymentRate = _newPaymntRate;

  ...
}
```

**Recommendation:** We recommend checking for an upper limit for the **paymentRate** variable.

**Update:** The LiquidNFTs team addressed this issue in the following pull request: <https://github.com/wise-foundation/liquidnfts-audit-scope/pull/1/files>.

## Conclusion

LiquidLocker LiquidBase, LiquidHelper, LiquidLocker, LiquidTransfer contracts were audited. 1 low severity issue was found.

The code is well documented and well written.

**Update:** The low severity issue was fixed in the update (pull request <https://github.com/wise-foundation/liquidnfts-audit-scope/pull/1/files>).



## Disclaimer

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This report should not be used in any way to make decisions around investment or involvement with any particular project. This report in no way provides investment advice, nor should be leveraged as investment advice of any sort. This report represents an extensive assessing process intending to help our customers increase the quality of their code while reducing the high level of risk presented by cryptographic tokens and blockchain technology.

## Slither output

```

LiquidLocker.enableLocker(uint256) (LiquidLocker.sol#245-299) uses a dangerous strict
equality:
    - require(bool,string)(paymentTimeNotSet() == true,LiquidLocker:
ENABLED_LOCKER) (LiquidLocker.sol#256-259)
LiquidHelper.floorNotReached() (LiquidHelper.sol#45-51) uses a dangerous strict
equality:
    - contributionPhase() == false && belowFloorAsked() == true
(LiquidHelper.sol#50)
LiquidLocker.liquidateLocker() (LiquidLocker.sol#487-511) uses a dangerous strict
equality:
    - require(bool,string)(missedActivate() == true || missedDeadline() ==
true,LiquidLocker: T00_EARLY) (LiquidLocker.sol#490-494)
LiquidLocker.onlyDuringContributionPhase() (LiquidLocker.sol#26-33) uses a dangerous
strict equality:
    - require(bool,string)(contributionPhase() == true && paymentTimeNotSet() ==
true,LiquidLocker: INVALID_PHASE) (LiquidLocker.sol#27-31)
LiquidLocker.payBackFunds(uint256,address) (LiquidLocker.sol#429-481) uses a dangerous
strict equality:
    - require(bool,string)(missedDeadline() == false,LiquidLocker: T00_LATE)
(LiquidLocker.sol#436-439)
LiquidLocker.payBackFunds(uint256,address) (LiquidLocker.sol#429-481) uses a dangerous
strict equality:
    - payedTimestamp == finalTimestamp (LiquidLocker.sol#462)
LiquidHelper.paymentTimeNotSet() (LiquidHelper.sol#127-133) uses a dangerous strict
equality:
    - nextDueTime == 0 (LiquidHelper.sol#132)
LiquidLocker.refundDueExpired(address) (LiquidLocker.sol#367-388) uses a dangerous
strict equality:
    - require(bool,string)(floorNotReached() == true || ownerlessLocker() ==
true,LiquidLocker: ENABLED_LOCKER) (LiquidLocker.sol#372-376)
LiquidLocker.rescueLocker() (LiquidLocker.sol#343-362) uses a dangerous strict
equality:
    - require(bool,string)(paymentTimeNotSet() == true,LiquidLocker:
ALREADY_STARTED) (LiquidLocker.sol#356-359)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#dangerous-strict-equalities

```

Reentrancy in LiquidLocker.refundDueExpired(address) (LiquidLocker.sol#367-388):

External calls:

- \_refundTokens(tokenAmount,\_refundAddress) (LiquidLocker.sol#380-383)
- (success,data) =

\_token.call(abi.encodeWithSelector(TRANSFER,\_to,\_value)) (LiquidHelper.sol#282-288)

State variables written after the call(s):

- \_decreaseTotalCollected(tokenAmount) (LiquidLocker.sol#385-387)
- totalCollected = totalCollected - \_decreaseAmount

(LiquidHelper.sol#247-248)

Reference: <https://github.com/crytic/slither/wiki/Detector-Documentation#reentrancy-vulnerabilities-1>

LiquidLocker.initialize(uint256[],address,address,uint256,uint256,uint256,uint256) (LiquidLocker.sol#39-62) should emit an event for:

- totalAsked = \_totalAsked (LiquidLocker.sol#60)

LiquidLocker.donateFunds(uint256) (LiquidLocker.sol#413-421) should emit an event for:

- claimableBalance = claimableBalance + \_donationAmount

(LiquidLocker.sol#419-420)

Reference: <https://github.com/crytic/slither/wiki/Detector-Documentation#missing-events-arithmetic>

LiquidTransfer.\_transferNFT(address,address,address,uint256) (LiquidTransfer.sol#20-59) has external calls inside a loop: (success) = address(\_tokenAddress).call(data) (LiquidTransfer.sol#51-53)

Reference: <https://github.com/crytic/slither/wiki/Detector-Documentation/#calls-inside-a-loop>

Reentrancy in LiquidLocker.\_claimInterest(address) (LiquidLocker.sol#661-685):

External calls:

- \_safeTransfer(PAYMENT\_TOKEN,\_claimAddress,tokensToTransfer)

(LiquidLocker.sol#675-679)

- (success,data) =

\_token.call(abi.encodeWithSelector(TRANSFER,\_to,\_value)) (LiquidHelper.sol#282-288)

Event emitted after the call(s):

- ClaimMade(tokensToTransfer,\_claimAddress) (LiquidLocker.sol#681-684)

Reentrancy in LiquidLocker.\_refundTokens(uint256,address) (LiquidLocker.sol#690-709):

External calls:

- \_safeTransfer(PAYMENT\_TOKEN,\_refundAddress,\_refundAmount)

(LiquidLocker.sol#699-703)

- (success,data) =

\_token.call(abi.encodeWithSelector(TRANSFER,\_to,\_value)) (LiquidHelper.sol#282-288)

Event emitted after the call(s):

- RefundMade(\_refundAmount,\_refundAddress) (LiquidLocker.sol#705-708)

Reentrancy in LiquidLocker.enableLocker(uint256) (LiquidLocker.sol#245-299):

External calls:

- \_safeTransfer(PAYMENT\_TOKEN,msg.sender,totalCollected - \_prepayAmount - teamsPayback) (LiquidLocker.sol#283-287)

- (success,data) =

\_token.call(abi.encodeWithSelector(TRANSFER,\_to,\_value)) (LiquidHelper.sol#282-288)

- \_safeTransfer(PAYMENT\_TOKEN,TRUSTEE\_MULTISIG,teamsPayback)

(LiquidLocker.sol#289-293)

- (success,data) =

\_token.call(abi.encodeWithSelector(TRANSFER,\_to,\_value)) (LiquidHelper.sol#282-288)

Event emitted after the call(s):

- PaymentMade(\_prepayAmount,msg.sender) (LiquidLocker.sol#295-298)

Reference: <https://github.com/crytic/slither/wiki/Detector-Documentation#reentrancy-vulnerabilities-3>

LiquidHelper.floorNotReached() (LiquidHelper.sol#45-51) uses timestamp for comparisons

Dangerous comparisons:

- contributionPhase() == false && belowFloorAsked() == true

(LiquidHelper.sol#50)

LiquidHelper.missedActivate() (LiquidHelper.sol#86-94) uses timestamp for comparisons

Dangerous comparisons:

- floorNotReached() && startingTimestamp() + DEADLINE\_TIME < block.timestamp

(LiquidHelper.sol#91-93)

LiquidHelper.missedDeadline() (LiquidHelper.sol#99-111) uses timestamp for comparisons

Dangerous comparisons:

- nextDueTime > 0 && nextDueOrDeadline + DEADLINE\_TIME < block.timestamp

(LiquidHelper.sol#108-110)

LiquidHelper.contributionPhase() (LiquidHelper.sol#138-144) uses timestamp for comparisons

Dangerous comparisons:

- timeSince(creationTime) < CONTRIBUTION\_TIME (LiquidHelper.sol#143)

LiquidLocker.enableLocker(uint256) (LiquidLocker.sol#245-299) uses timestamp for comparisons

Dangerous comparisons:

- require(bool,string)(paymentTimeNotSet() == true,LiquidLocker:

ENABLED\_LOCKER) (LiquidLocker.sol#256-259)

LiquidLocker.rescueLocker() (LiquidLocker.sol#343-362) uses timestamp for comparisons

Dangerous comparisons:

- require(bool,string)(timeSince(creationTime) > DEADLINE\_TIME,LiquidLocker:

NOT\_ENOUGH\_TIME) (LiquidLocker.sol#351-354)

- require(bool,string)(paymentTimeNotSet() == true,LiquidLocker:

ALREADY\_STARTED) (LiquidLocker.sol#356-359)

LiquidLocker.refundDueExpired(address) (LiquidLocker.sol#367-388) uses timestamp for comparisons

Dangerous comparisons:

- require(bool,string)(floorNotReached() == true || ownerlessLocker() == true,LiquidLocker: ENABLED\_LOCKER) (LiquidLocker.sol#372-376)

LiquidLocker.payBackFunds(uint256,address) (LiquidLocker.sol#429-481) uses timestamp for comparisons

Dangerous comparisons:

- require(bool,string)(missedDeadline() == false,LiquidLocker: T00\_LATE) (LiquidLocker.sol#436-439)

- payedTimestamp == finalTimestamp (LiquidLocker.sol#462)

- payedTimestamp > block.timestamp (LiquidLocker.sol#476-478)

LiquidLocker.liquidateLocker() (LiquidLocker.sol#487-511) uses timestamp for comparisons

Dangerous comparisons:

- require(bool,string)(missedActivate() == true || missedDeadline() == true,LiquidLocker: T00\_EARLY) (LiquidLocker.sol#490-494)

LiquidLocker.getLateDays() (LiquidLocker.sol#580-587) uses timestamp for comparisons

Dangerous comparisons:

- block.timestamp > nextDueTime (LiquidLocker.sol#585-586)

Reference: <https://github.com/crytic/slither/wiki/Detector-Documentation#block-timestamp>

LiquidHelper.floorNotReached() (LiquidHelper.sol#45-51) compares to a boolean constant:

- contributionPhase() == false && belowFloorAsked() == true

(LiquidHelper.sol#50)

LiquidLocker.enableLocker(uint256) (LiquidLocker.sol#245-299) compares to a boolean constant:

- require(bool,string)(belowFloorAsked() == false,LiquidLocker: BELOW\_FLOOR)

(LiquidLocker.sol#251-254)

LiquidLocker.enableLocker(uint256) (LiquidLocker.sol#245-299) compares to a boolean constant:

- require(bool,string)(paymentTimeNotSet() == true,LiquidLocker: ENABLED\_LOCKER)

(LiquidLocker.sol#256-259)

LiquidLocker.disableLocker() (LiquidLocker.sol#305-315) compares to a boolean constant:

- require(bool,string)(belowFloorAsked() == true,LiquidLocker: FLOOR\_REACHED)

(LiquidLocker.sol#309-312)

LiquidLocker.rescueLocker() (LiquidLocker.sol#343-362) compares to a boolean constant:

```

    -require(bool,string)(paymentTimeNotSet() == true,LiquidLocker:
ALREADY_STARTED) (LiquidLocker.sol#356-359)
LiquidLocker.refundDueExpired(address) (LiquidLocker.sol#367-388) compares to a boolean
constant:
    -require(bool,string)(floorNotReached() == true || ownerlessLocker() ==
true,LiquidLocker: ENABLED_LOCKER) (LiquidLocker.sol#372-376)
LiquidLocker.refundDueSingle(address) (LiquidLocker.sol#393-407) compares to a boolean
constant:
    -require(bool,string)(notSingleProvider(_refundAddress) == true,LiquidLocker:
INVALID_SENDER) (LiquidLocker.sol#398-401)
LiquidLocker.payBackFunds(uint256,address) (LiquidLocker.sol#429-481) compares to a
boolean constant:
    -require(bool,string)(missedDeadline() == false,LiquidLocker: T00_LATE)
(LiquidLocker.sol#436-439)
LiquidLocker.liquidateLocker() (LiquidLocker.sol#487-511) compares to a boolean
constant:
    -require(bool,string)(missedActivate() == true || missedDeadline() ==
true,LiquidLocker: T00_EARLY) (LiquidLocker.sol#490-494)
LiquidLocker.onlyDuringContributionPhase() (LiquidLocker.sol#26-33) compares to a
boolean constant:
    -require(bool,string)(contributionPhase() == true && paymentTimeNotSet() ==
true,LiquidLocker: INVALID_PHASE) (LiquidLocker.sol#27-31)
LiquidTransfer._transferNFT(address,address,address,uint256) (LiquidTransfer.sol#20-59)
compares to a boolean constant:
    -require(bool,string)(success == true,NFT_TRANSFER_FAILED)
(LiquidTransfer.sol#55-58)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#boolean-equality

```

```

LiquidHelper._safeTransferFrom(address,address,address,uint256)
(LiquidHelper.sol#303-328) is never used and should be removed
LiquidTransfer._transferFromNFT(address,address,address,uint256)
(LiquidTransfer.sol#64-139) is never used and should be removed
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#dead-code

```

Pragma version=0.8.12 (LiquidBase.sol#3) necessitates a version too recent to be trusted. Consider deploying with 0.6.12/0.7.6/0.8.7

Pragma version=0.8.12 (LiquidHelper.sol#3) necessitates a version too recent to be trusted. Consider deploying with 0.6.12/0.7.6/0.8.7

Pragma version=0.8.12 (LiquidLocker.sol#3) necessitates a version too recent to be trusted. Consider deploying with 0.6.12/0.7.6/0.8.7

Pragma version=0.8.12 (LiquidTransfer.sol#3) necessitates a version too recent to be trusted. Consider deploying with 0.6.12/0.7.6/0.8.7  
 solc-0.8.12 is not recommended for deployment  
 Reference: <https://github.com/crytic/slither/wiki/Detector-Documentation#incorrect-versions-of-solidity>

Low level call in LiquidHelper.\_safeTransfer(address,address,uint256)

(LiquidHelper.sol#275-298):

- (success,data) = \_token.call(abi.encodeWithSelector(TRANSFER,\_to,\_value))

(LiquidHelper.sol#282-288)

Low level call in LiquidHelper.\_safeTransferFrom(address,address,address,uint256)

(LiquidHelper.sol#303-328):

- (success,data) =

\_token.call(abi.encodeWithSelector(TRANSFER\_FROM,\_from,\_to,\_value))

(LiquidHelper.sol#311-318)

Low level call in LiquidTransfer.\_transferNFT(address,address,address,uint256)

(LiquidTransfer.sol#20-59):

- (success) = address(\_tokenAddress).call(data) (LiquidTransfer.sol#51-53)

Low level call in LiquidTransfer.\_transferFromNFT(address,address,address,uint256)

(LiquidTransfer.sol#64-139):

- (checkSuccess,result) = address(\_tokenAddress).staticcall(punkIndexToAddress)

(LiquidTransfer.sol#87-89)

- (buySuccess,buyResultData) = address(\_tokenAddress).call(buyData)

(LiquidTransfer.sol#107-109)

- (success,resultData) = address(\_tokenAddress).call(data)

(LiquidTransfer.sol#131-133)

Reference: <https://github.com/crytic/slither/wiki/Detector-Documentation#low-level-calls>

Parameter LiquidHelper.notSingleProvider(address).\_checkAddress (LiquidHelper.sol#57) is not in mixedCase

Parameter LiquidHelper.reachedTotal(address,uint256).\_contributor (LiquidHelper.sol#73) is not in mixedCase

Parameter LiquidHelper.reachedTotal(address,uint256).\_tokenAmount (LiquidHelper.sol#74) is not in mixedCase

Parameter LiquidHelper.timeSince(uint256).\_timeStamp (LiquidHelper.sol#196) is not in mixedCase

Parameter LiquidLocker.initialize(uint256[],address,address,uint256,uint256,uint256,uint256).\_tokenId (LiquidLocker.sol#40) is not in mixedCase

Parameter LiquidLocker.initialize(uint256[],address,address,uint256,uint256,uint256,uint256).\_tokenAddress (LiquidLocker.sol#41) is not in mixedCase

Parameter LiquidLocker.initialize(uint256[],address,address,uint256,uint256,uint256,uint256).\_tokenOwner (LiquidLocker.sol#42) is not in mixedCase

Parameter LiquidLocker.initialize(uint256[],address,address,uint256,uint256,uint256,uint256).\_floorAsked (LiquidLocker.sol#43) is not in mixedCase

Parameter LiquidLocker.initialize(uint256[],address,address,uint256,uint256,uint256,uint256).\_totalAsked (LiquidLocker.sol#44) is not in mixedCase

Parameter LiquidLocker.initialize(uint256[],address,address,uint256,uint256,uint256,uint256).\_paymentTime (LiquidLocker.sol#45) is not in mixedCase

Parameter LiquidLocker.initialize(uint256[],address,address,uint256,uint256,uint256,uint256).\_paymentRate (LiquidLocker.sol#46) is not in mixedCase

Parameter LiquidLocker.increasePaymentRate(uint256).\_newPaymntRate (LiquidLocker.sol#68) is not in mixedCase

Parameter LiquidLocker.decreasePaymentTime(uint256).\_newPaymentTime (LiquidLocker.sol#92) is not in mixedCase

Parameter LiquidLocker.updateSettings(uint256,uint256).\_newPaymntRate (LiquidLocker.sol#114) is not in mixedCase

Parameter LiquidLocker.updateSettings(uint256,uint256).\_newPaymentTime (LiquidLocker.sol#115) is not in mixedCase

Parameter LiquidLocker.makeContribution(uint256,address).\_tokenAmount (LiquidLocker.sol#151) is not in mixedCase

Parameter LiquidLocker.makeContribution(uint256,address).\_tokenHolder (LiquidLocker.sol#152) is not in mixedCase

Parameter LiquidLocker.enableLocker(uint256).\_prepayAmount (LiquidLocker.sol#246) is not in mixedCase

Parameter LiquidLocker.refundDueExpired(address).\_refundAddress (LiquidLocker.sol#368) is not in mixedCase

Parameter LiquidLocker.refundDueSingle(address).\_refundAddress (LiquidLocker.sol#394) is not in mixedCase

Parameter LiquidLocker.donateFunds(uint256).\_donationAmount (LiquidLocker.sol#414) is not in mixedCase

Parameter LiquidLocker.payBackFunds(uint256,address).\_paymentAmount (LiquidLocker.sol#430) is not in mixedCase

Parameter LiquidLocker.payBackFunds(uint256,address).\_paymentAddress (LiquidLocker.sol#431) is not in mixedCase

Parameter LiquidLocker.penaltyAmount(uint256,uint256).\_totalCollected (LiquidLocker.sol#517) is not in mixedCase

Parameter LiquidLocker.penaltyAmount(uint256,uint256).\_lateDaysAmount (LiquidLocker.sol#518) is not in mixedCase

Parameter LiquidLocker.calculatePaybacks(uint256,uint256,uint256).\_totalValue (LiquidLocker.sol#595) is not in mixedCase

Parameter LiquidLocker.calculatePaybacks(uint256,uint256,uint256).\_paymentTime



(LiquidLocker.sol#596) is not in mixedCase  
Parameter LiquidLocker.calculatePaybacks(uint256,uint256,uint256).\_paymentRate  
(LiquidLocker.sol#597) is not in mixedCase  
Parameter LiquidLocker.calculateEpoch(uint256,uint256,uint256).\_totalValue  
(LiquidLocker.sol#623) is not in mixedCase  
Parameter LiquidLocker.calculateEpoch(uint256,uint256,uint256).\_paymentTime  
(LiquidLocker.sol#624) is not in mixedCase  
Parameter LiquidLocker.calculateEpoch(uint256,uint256,uint256).\_paymentRate  
(LiquidLocker.sol#625) is not in mixedCase  
Parameter LiquidTransfer.onERC721Received(address,address,uint256,bytes).\_operator  
(LiquidTransfer.sol#149) is not in mixedCase  
Parameter LiquidTransfer.onERC721Received(address,address,uint256,bytes).\_from  
(LiquidTransfer.sol#150) is not in mixedCase  
Parameter LiquidTransfer.onERC721Received(address,address,uint256,bytes).\_tokenId  
(LiquidTransfer.sol#151) is not in mixedCase  
Parameter LiquidTransfer.onERC721Received(address,address,uint256,bytes).\_data  
(LiquidTransfer.sol#152) is not in mixedCase  
Reference: <https://github.com/crytic/slither/wiki/Detector-Documentation#conformance-to-solidity-naming-conventions>

getTokens() should be declared external:

- LiquidHelper.getTokens() (LiquidHelper.sol#34-40)

Reference: <https://github.com/crytic/slither/wiki/Detector-Documentation#public-function-that-could-be-declared-external>

LiquidLocker.sol analyzed (4 contracts with 77 detectors), 84 result(s) found



 Guard